

## DESCRIPTION OF A NEW *APISTOGRAMMA* SPECIES (TELEOSTEI, CICHLIDAE) FROM THE RIO NEGRO IN BRAZIL

by

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**ABSTRACT.** - *Apistogramma paucisquamis* n. sp. is described on the basis of 96 specimens, 12.8-31.2 mm SL, from the middle and lower Rio Negro in Brazil. The species is distinguished from all other *Apistogramma* species by having 12 instead of 16 circumpeduncular scale rows. The impressive large mouth may correlate with plankton feeding or, more likely, with the frontal threat display. *Apistogramma paucisquamis* keeps the mouth wide open during frontal threat display, whereas the majority of the *Apistogramma* species keep it closed during the same behaviour. Open mouth frontal threat display is shared with species of the *A. agassizii* and *A. cactuoides* species groups, and *A. paucisquamis* may be closely related to these, although precise relationships cannot be discerned on the basis of available information.

**RÉSUMÉ.** - *Apistogramma paucisquamis* n. sp. est décrite d'après 96 exemplaires de 12,8 à 31,2 mm de LS, provenant du cours moyen et inférieur du Rio Negro (Brésil). L'espèce se distingue des autres espèces du genre *Apistogramma* par 12 rangées d'écaillles autour du pédoncule caudal au lieu de 16. Sa bouche assez grande peut correspondre à un régime planctonivore ou, plus probablement, à la parade d'affrontement agressif. *Apistogramma paucisquamis* écarte la bouche au maximum pendant la parade frontale de combat, alors que la majorité des espèces d'*Apistogramma* la maintient fermée pendant le même comportement. La parade frontale avec bouche ouverte existe également chez les espèces des groupes *A. agassizii* et *A. cactuoides*; *A. paucisquamis* peut être proche de ces groupes, bien que les informations disponibles ne permettent pas d'établir des affinités précises.

**Key-words :** *Apistogramma paucisquamis*, Brazil, Cichlidae, New Species, Taxonomy.

The new species described below is an example of those many cichlid species which become well-known in popular literature long before material is available for a formal description. In the genus *Apistogramma* Regan there are more than a dozen such species (cf. Koslowski, 1985), provisionally referred to by popular names such as 'Parallelstreifen - *Apistogramma*' and 'Rotkeil - *Apistogramma*'. The species referred to as 'Glanzbinden-*Apistogramma*' appears to have been in the aquarium trade in the 1960s, as a specimen was included in the composite paratype series of *Apistogramma gibbiceps* by Meinken (1969). The type series of *A. gibbiceps* consists of specimens obviously kept in aquarium, and without locality data. There is no other material or literature on Glanzbinden-*Apistogramma* until Schmettkamp (1981) reported on its introduction in the German aquarium hobby and coined the popular name. Subsequently, the species was described and illustrated in colour by Schmettkamp (1982), Linke and Staack (1984) and Koslowski (1982, 1985).

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Material with locality data was collected already in 1980 by Michael Goulding. That series, from the middle Rio Negro, consists of rather small specimens, and a formal description was postponed in expectation of series including adults displaying characteristic secondary sexual features. Such material was recently collected by one of us (WS) in the lower Rio Negro, and it allows us to present a formal description of the Glanzbinden-*Apistogramma*.

## METHODS

The techniques for taking measurements and meristic data are described by Kullander (1980 a, 1980 b). Material for osteological study was prepared using a modification of the clearing and staining procedure described by Dingerkus and Uhler (1977).

Study specimens are deposited in the following institutions : Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP), Swedish Museum of Natural History, Stockholm (NRM), Forschungsinstitut und Museum Senckenberg, Frankfurt/Main (SMF), National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM), Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK).

### *APISTOGRAMMA PAUCISQUAMIS* N.SP.

(Figs 1-8, Tables I, II)

*Apistogramma gibbiceps* (part) Meinken, 1969, p. 91 (one paratype, SMF 9450).

**Diagnosis :** Distinguished from all other *Apistogramma* species by having only 12 instead of 16 circumpeduncular scale rows. Similar to *A. bitaeniata* Pellegrin in colour pattern (two horizontal lateral bands), cephalic lateralis canal system (two infraorbitals, posterior with two foramina only ; and four dentary foramina), and lyreate caudal fin shape ; distinguished by low dorsal fin without produced lappets and wide branchiostegal membrane in addition to circumpeduncular squamation.

**Material examined :** All wild material from Brazil, Estado do Amazonas, Rio Negro drainage.

**Holotype** (Fig. 1) : MZUSP 36952. Adult male, 29.7 mm SL. Arquipélago das Anavilhanas, small shallow bay on the right bank of Rio Negro. 27 Mar 1986. W. Staack (BR10/86).

**Paratypes** : NRM A86/1986134.3587 (15), USNM 289281 (5), ZFMK 15496-15500 (5), MZUSP uncat. (4). 17 males, 21.2-28.9 mm SL, 12 females, 16.4-23.2 mm SL. Same data as holotype. -- NRM A86/1986134.3594. 5 males, 26.2-31.2 mm SL. Arquipélago das Anavilhanas, baylet with small clear water creek at right bank of Rio Negro S Novo Airão. 27 Mar 1986. W. Staack (Br9/86). -- MZUSP 28210 (57), NRM A83/1980077.3058 (4). 61, 12.8-25.9 mm SL. Downstream of R. Daraã, central lake in Rio Negro. 17 Feb 1980. M. Goulding.

**Non-types** : NRM uncat. 2 males, 28.5-33.9 mm SL. Aquarium. Ded. I. Koslowski, 8 Jun 1981. -- NRM uncat. 1 female, 26.8 mm SL. Aquarium. Ded. I. Koslowski, 1 Dec 1980. -- SMF 9450. 1 female, 26.2 mm SL. 'Brasilien, Rio Negro-Gebiet ?' Ded. W. Schwartz, 1967. Paratype of *Apistogramma gibbiceps* Meinken.



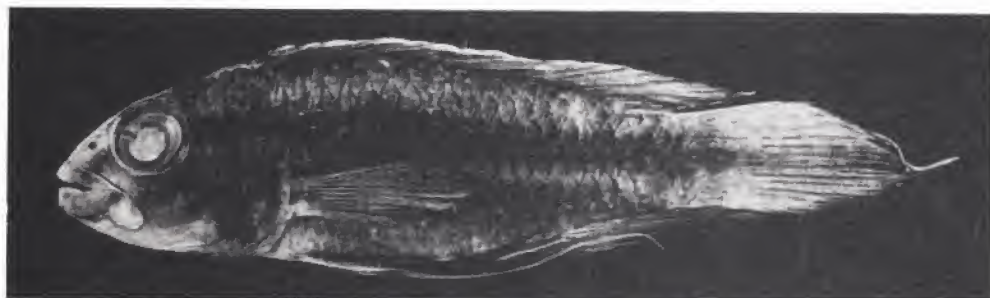


Fig. 1 : *Apistogramma paucisquamis*, holotype, MZUSP 36952, adult male.

**Description :** Based on holotype, with notes on variation as indicated, principally from topoparatype series. Counts are from 15 measured specimens ; measurements are summarized in Table I.

Elongate, laterally compressed ; dorsal and ventral contours caudal to head about horizontal, excepting sloping anal fin base and ventral margin of caudal peduncle. Predorsal contour slightly curved, rising to below anterior part of dorsal fin ; prepelvic contour much less angled ; almost horizontal posterior to lower jaw. In anterior view head sides nearly straight vertical, nape and chest flattened. Mouth large (Fig. 2a), maxilla reaching almost to vertical from middle of orbit, lower jaw articulation below posterior half of orbit, ascending premaxillary processes reaching to 1/3 of orbit. Lip folds wide and thick. Snout broadly rounded in dorsal and lateral aspect. Orbit chiefly in anterior and upper halves of head, touching predorsal contour. Interorbital area flattened, much narrower than mouth. Females and young males have much shorter snout, with sloping, nearly equal predorsal and prepelvic contour and smaller mouth (maxilla reaching only slightly beyond anterior margin of orbit, lower jaw articulation below middle of orbit). Exposed branchiostegal membrane wide (Fig. 2a). Preoperculum, supracleithrum and posttemporal entire.

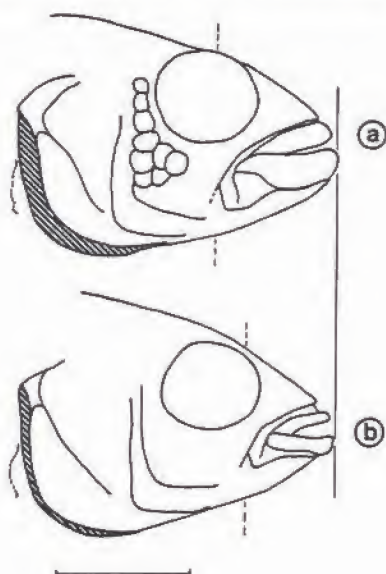


Fig. 2 : Head outlines in (a) *Apistogramma paucisquamis* (MZUSP 36952, holotype, male, 29.7 mm SL) and (b) *Apistogramma bitaeniata* (NRM SOK / 1984334.3884, male, 30.8 mm SL), to show difference in jaw length (maxillary extension indicated by dashed line), and width of branchiostegal membrane (hatched) at about same body and head length. Scales added to *A. paucisquamis*. Scale = 5 mm.





Scales in a lateral row (squ. long.) 21(4), 22(11). Scales ctenoid except predorsally, preventrally, anteriorly on cheek, on interoperculum and distal caudal fin scales. Predorsal scales 7(1), 8(5), 9(8), 10(1). Naked on chest anterior to tips of cleithra, except in one specimen. Prepelvic scales 6(7), 7(7), 7 + 1 (1). Anteroventral half of cheek naked (Fig. 2a). Cheek scale rows 2(12), 3(3). Opercular scales - (5), 8(1), 9(2), 10(2), 11(4), 13(1); arranged in 3 rows. Subopercular scales - (1), 2(1), 3(2), 4(7), 5(4); in 1-2 rows. Interopercular scales 2(2), 3(13); in a single row. Basal 1/3 of caudal fin scaled. Circumpeduncular scale rows 12 (Fig. 3; see discussion). Scales between upper lateral line and dorsal fin base 3 (anteriorly) to 1/2 (posteriorly). Tubed lateral line scales 10(1), 11(4), 12(7), 13(1), 14(1), 15(1) in upper line; 3(4), 4(6), 5(3), 6(2) in lower line. Total lateral line scales 12(5), 13(4), 14(2), 15(4) in upper line; - (1), 6(7), 7(5), 8(2) in lower line.

Dorsal fin spines increasing in length to last or subequal in length from 7th. Dorsal fin lappets in males not reaching much beyond spine tips, truncate with posterior point; in females shorter, with rounded edge. Soft dorsal and anal fins pointed, reaching to about middle of caudal fin in males; rounded, reaching little beyond caudal fin base in females. Pelvic fin pointed; in adult males with first ray filamentously produced, reaching to at most beyond anal fin base; in females to second anal fin spine. Caudal fin subtruncate in females and young males; in adult females lyreate: rays increase in length from marginal to D3 and V3, rays D2 to V2 much shorter, streamers formed by rays D3 and V3 up to half length of rest of fin. The smallest male with caudal fin streamers is 21.0 mm SL. D. XV. 6(6), XV. 7(9). A. III. 6(14), III. 7(1). P. 11 (11), 12(4). Principal caudal fin rays - (1), 7 + 8 (4), 8 + 8 (10).

Suborbital series consisting in lacrimal with four openings, and two infraorbitals (Fig. 4). The canal through the second infraorbital extends along 2/3 of the ossicle, posteriorly the ossicle is compact; the second infraorbital is separated from the sphenotic by a narrow gap. Dentary canal usually with four foramina, and usually an anguloarticular canal. In 35 specimens surveyed, two (including holotype) lack anguloarticular canal bilaterally, and two lack it unilaterally; one specimen has five dentary foramina on the right side. In other respects the lateralis canal system is as in other *Apistogramma* (see Kullander, 1987 for discussion).

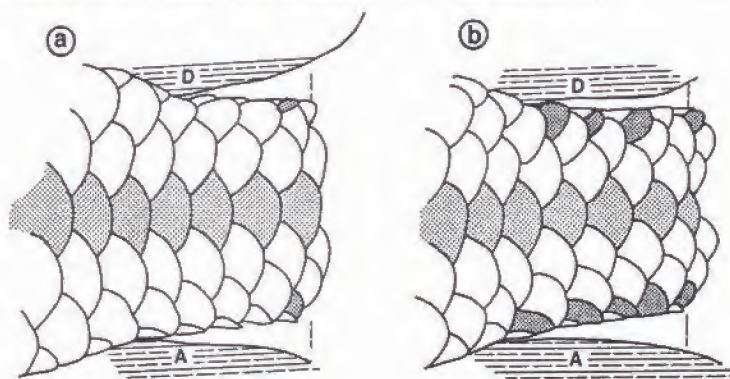


Fig. 3 : Caudal peduncle squamation in (a) *Apistogramma paucisquamis* (NRM A86/1986134.3587, 26.0 mm SL) and (b) *A. bitaeniata* (NRM SOK / 1984334.3884, 27.5 mm SL). Anterior is to the left. A anal fin, D dorsal fin. Light shading lateral line scale row, dense shading horizontal scale rows reduced in *A. paucisquamis*. Dashed line indicates end of caudal peduncle. Scale = 1 mm.

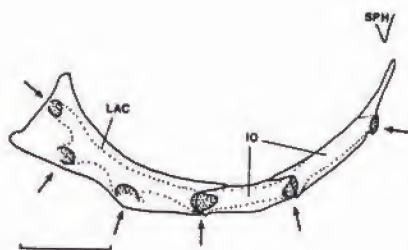


Fig. 4 : Left suborbital series of *Apistogramma paucisquamis* (NRM A86 / 1986134.3587, 24.9 mm SL, alizarin red-alcian blue transparency). Arrows point to lateralis canal openings. *IO* infraorbitals, *LAC* lacrimal, *SPH* tip of sphenotic to demonstrate space between sphenotic and infraorbital series. Scale = 1 mm.

Five large males measured have 17-26/19-23 teeth in the upper/lower jaw outer hemiseries. Outer row teeth larger than inner, anteriorly spaced and recurved at 90° angle (cf. Fig. 5) ; inner row in upper jaw reaching as far as outer ; in lower jaw a short inner row anteriorly and some additional inner teeth.

Gill rakers externally on first ceratobranchial 0(1), 1(8), 2(6). Gill rakers on lower pharyngeal tooth plate - (1), 10(2), 11(1), 12(5), 13(4), 14(1), 15(1). Lower pharyngeal tooth plate wider than long ; anterior teeth subconical ; posterior teeth compressed, with posterior cusp and anterior shelf or minor cusp on rostral edge.

Vertebrae in three cleared and stained specimens ; 24 in one, with hemal canal from 11th, hemal spine from 12th (interjected between first two interhemals), basapophyses to 12th, pleural ribs to 11th, epipleural ribs to 13th vertebra. 25 in two, with hemal canal from 12th, hemal spine from 12th or 13th (interjected between first two interhemals), basapophyses and pleural ribs to 12th, epipleural ribs to 14th vertebra ; vertebrae 23-24 co-ossified in one.

#### Colouration :

*In preservative* : Holotype (Fig. 1), representing adult males : Dirty whitish on chest and belly, pale brownish on sides. Cheek light brown ; forehead, snout and lips grey. Branchiostegal membrane greyish. Operculum and suboperculum dark brown, with some lighter pigment patches ; suboperculum usually light in other specimens. Lower jaw, horizontal limb of preoperculum, interoperculum, maxillary tip greyish white. Chin anteriorly dusky but no distinct chin spot formed.

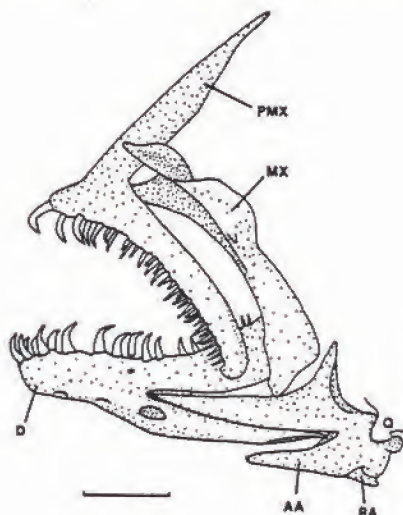


Fig. 5 : Lateral aspect of jaws of *Apistogramma paucisquamis* (NRM A86/1986134.3587, 27.8 mm SL, alizarin red-alcian blue transparency ; specimen lacking anguloarticular lateralis canal). *AA* anguloarticular, *D* dentary, *MX* maxilla, *PMX* premaxilla, *Q* articular head of quadrate, *RA* retroarticular. Scale = 1 mm.



Preorbital stripe indistinct in dark snout colour. Dark stripe on cheek along infraorbital margin. Blackish suborbital stripe from between two posterior infraorbital pores to adjacent edges of sub- and inter-opercula. No supraorbital stripe. Nape and back close to dorsal fin base dark brown. No vertical bars.

Postorbital stripe dark brown ; continuous with sharp-edged dark brown lateral band extending onto scaled caudal fin base. Lateral band ca 1 1/2 scale deep, anteriorly in squ. long. scales and upper half of scales below, posteriorly in lower lateral line scales and lower half of scales above. Lateral spot black, roundish, nearly completely contained in lateral band. Lateral band margined ventrally by a narrow light zone, separating lateral band from a wide dark band, 1 1/2-2 scales wide, from pectoral axilla caudad to posterior part of anal fin base and caudal fin base. This ventral horizontal band is always paler than the lateral band.

Most flank scales with dark posterior edge, which concentrated to a spot in darker areas such as the two horizontal bands. In some of the smaller specimens the ventral horizontal band is faintly expressed, though dark spots at scale edges are prominent.

A dark brown spot on pale red ground between vent and anal fin origin. Blackish spot on dorsal edge of pectoral axilla and a greyish spot on bases of middle pectoral fin rays.

Dorsal fin greyish brown, with darkened base on hyaline, narrowly black-margined lappets ; three rows of hyaline dots alternating with red to brownish dots across last three membranes. Anal fin greyish brown (in specimens with lighter anal fin a wide dark lower margin) and light/brownish dots on last two membranes. Pelvic fin with white anterior margin and filamentous tip, otherwise brownish grey, lighter inwardly. Caudal fin with base brownish like body, and continuation of lateral band on scaled base ; narrow black margin dorsal and ventral to streamers ; across entire fin about eight irregular rows of red to brown dots alternating with hyaline dots (the red pigment obviously giving way to brown after some time in preservative) ; most males with a wide light submarginal zone along black border.

Females with first dorsal and anal fin spine and interspinous membrane black ; pelvic fin with anterior edge white, outer two membranes black, rest hyaline ; genital papilla contrastingly white against black spot between vent and anal fin, black line around vent, and variously long dark midventral stripe (not reaching to pelvic fin bases) ; larger, more scattered hyaline dots on unpaired fins. Young males are readily distinguished from large females by their paler pelvic fin and lack of midventral stripe.

*Life colours* : Variation in life colours is notable among adult males. In the field, three extremes were distinguished with reference mainly to the distribution of rich orange shades over head, body, dorsal fin and caudal fin. All three extremes and their intermediates were found at the type locality. Type 1 seemed to be by far the most frequent.

Type 1 : Cheeks, lower part of head, belly and region around the lateral spot, deep orange ; chest whitish. Dorsal fin almost hyaline, but with pale yellowish hue and dark base ; lappets with orange margin and narrow blue submarginal line. Caudal fin with greyish ground colour, more or less hyaline.

Type 2 : Cheeks greyish brown ; chest and belly whitish. Ground colour of sides dark grey. Dorsal fin deep orange except for dark base and thin submarginal partly dark, partly bluish line. Caudal fin with greyish ground colour, more or less hyaline.

Type 3 : Cheeks greyish brown ; chest and belly whitish. Ground colour of sides dark grey. Dorsal fin almost hyaline, but with pale yellowish blue and dark base ; lappets with orange margin and narrow pale blue submarginal line. Ground colour of caudal fin deep orange.

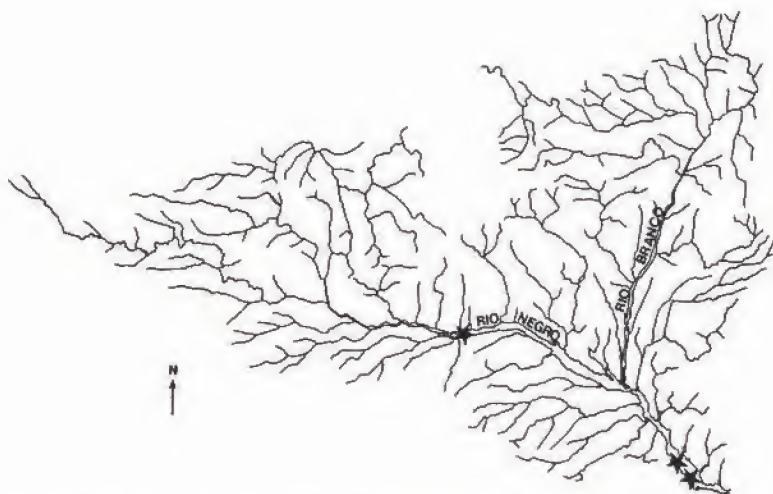


Fig. 6 : Collecting localities of *Apistogramma paucisquamis* plotted on a map of the R. Negro drainage ; in downstreams succession : near R. Daraã, station Br9/86, station Br10/86 (type locality).

All males have bright blue dots on the lower part of the head and bordering the postorbital stripe. Above and below the dark lateral band runs a narrow metallic blue or greenish line, which is most conspicuous posteriorly on the side. Caudal fin and soft parts of dorsal and anal fin with rows of maroon or dark dots. Central part of anal fin maroon, rest bluish. Inner part of pelvic fins dark grey, rest dark blue ; anterior edge and filamentous tip white.

**Geographical distribution** (Fig. 6) : So far known only from the central and lower part of the Rio Negro. In the Arquipélago das Anavilhanas area the species was found only on the right bank. Several collections were made on the left bank in biotopes similar to those in which *A. paucisquamis* were collected, but no *A. paucisquamis* were found at these localities.

#### Ecology :

**Habitat** : The localities at the lower R. Negro (Br9-10, and three intermediate localities where no fish were preserved) are typical black water biotopes containing clear, tea-coloured water. Water data for Br9/86 at 1100 h are : temperature 26° C, total and temporary hardness both below 1°dH, pH 4.3.

Associated cichlid species preserved at Br10/86 are *Apistogramma pertensis* (Haseman), *Satanoperca jurupari* (Heckel), *Aequidens pallidus* (Heckel) and *Acaronia nassa* (Heckel). A single *Apistogramma diplotaenia* Kullander was obtained in addition to the *A. paucisquamis* at Br9/86. Other fish frequently collected together with *A. paucisquamis* were *Copella nattereri* (Steindachner), *Pyrrhulina brevis* Steindachner, and a *Rivulus* species.

There is some indication that *A. paucisquamis* prefers extremely shallow habitats, i.e., a water depth between 10 and 40 cm. This, however, does not mean that the species is restricted to creeks, pools or other small water bodies. On the contrary, *A. paucisquamis* is common on the banks of the main arms of the Rio Negro wherever suitable biotopes are available. But there is a distinct correlation between the gradient angle of the bottom and the abundance of the species.



At four localities with a rather steeply sloping bottom (depth reaching 40-50 cm at about 0.5 m from the shoreline) *A. paucisquamis* was rare. On the average only one specimen was caught per 10 m shoreline. At the type locality (Br10/86), with a wider zone of shallow water (the water depth reached 40 cm only at a distance of 1 m from the shoreline), one fish was caught per 1 m of shoreline, indicating a comparatively high population density at this site. The most prominent feature of the habitats of *A. paucisquamis* is a thick layer of dead leaves covering the bottom of the bank side. The *Apistogramma* lead a very furtive life in the space under and among the leaves, which provide them cover and protection. As there are no stones in those biotopes, the only suitable substrate available for egg deposition is forest litter.

**Food :** Intestinals were removed from the three cleared and stained specimens (27.8, 27.9, 24.9 mm SL). All are males with well-developed testes (length 14.9 and 16.5 % of SL in the two larger). The intestines are short (length 72.0 and 77.3 % of SL in the two larger). The stomach-intestinal arrangement (Fig. 7) corresponds closely to Zihler's (1982) type C. The stomach and adjacent intestine is empty ; the two larger specimens have the intestine nearly full, the intestine of the small specimen is about half-full with gaps between faeces. All three contain anomopod cladoceran shells as chief identifiable food matter ; the 27.8 mm specimen also four intact water mites and two intact nematodes, part of a terrestrial insect and part of an aquatic insect larva. The 27.9 mm specimen has some leeches, a few copepods, plant matter, diatoms in addition to unidentifiable matter that predominates in the smallest specimen. As judged from these specimens, *A. paucisquamis* appears to feed mainly on zooplankton, with an occasional nip at substrate ; intestinal contents should not be as indicative of food preferences as stomach contents, however.

Knöppel (1970) found a significant quantity of mites in *A. agassizii* (Steindachner) stomachs and implicitly suggested that it was also a significant food item. In the *A. paucisquamis* intestine containing mites, these are virtually unmolested although they are in about the middle of the intestine.

**Etymology :** The species epithet is an adjectivated noun combined from the Latin *paucus*, few, and *squama*, scale, referring to the reduced caudal peduncle squamation that is a distinguishing feature of the species.



Fig. 7 : *Apistogramma paucisquamis*. Dorsal aspect of alimentary tract. S. Stomach. Scale = 1 mm. From NRM A86/1986134.3587, 27.8 mm SL.

## DISCUSSION

**Differences from *Apistogramma sweglesi* Meinken (1961) :** Schmettkamp (1981) compared the 'Glanzbinden-*Apistogramma*' with *A. sweglesi*, as there is a marked similarity in colour pattern with the figure of *A. sweglesi* given by Meinken (1961). The type material of *A. sweglesi* is lost (Kullander, 1980a, 1986) ; thus the identity of the species is somewhat uncertain. The holotype, a large male, is figured and described as having produced anterior dorsal fin lappets, which would distinguish *A. sweglesi* from *A. paucisquamis*. Kullander (1986) suggested that *A. sweglesi* is most likely a synonym of *A. bitaeniata*.

**Distinguishing characters :**

**Mouth shape :** Adult males in the type series have characteristic thick lips and long jaws, distinguishing from other *Apistogramma* species (at same size) and young *A. paucisquamis*. Large males of *A. cactuoides* group species do show a similar head shape, as already noted by Koslowski (1985) for *A. cactuoides* Hoedeman. Long jaws (upper reaching nearly to below middle of orbit) and thick lips are also characteristic of large male *A. juruensis* Kullander (1986, pl. XIX, fig. 1), and *A. luelingi* Kullander (pers. obs.). Koslowski (1985, figs. pp. 128-129) illustrates males of *A. paucisquamis* with very large mouths (the size of the specimens is not stated). Visual inspection and limited measurement data suggest that emphasized positive size allometry of jaw lengths is a unique shared character of *A. paucisquamis* and *A. cactuoides* group species.

The *A. paucisquamis* males are notable for having large mouths at rather small size, less than 30 mm, whereas in the *A. cactuoides* group species large mouths are characteristic of specimens over 30 mm. *Apistogramma paucisquamis* seems to be a small species, however ; *A. cactuoides* reaches 50 mm SL (Kullander, 1986).

Figure 8 illustrates the strong positive size allometry of the jaws in *A. paucisquamis* contrasted to near isometry in an *A. regani* group species, *A. cruzi* Kullander. The linear regression ( $y = a + bx$ ) calculated for upper and lower jaw lengths as functions of SL are given in Table II. It should be noted that *A. cruzi* departs markedly in other body proportions, being in comparison with *A. paucisquamis* deep-bodied, short-headed and short-snouted, and apparently also growing larger.

There is a possibility that the lower Rio Negro material of *A. paucisquamis* represents stunted populations in which head features are disproportionately large for given SL. The *A. paucisquamis* males have relatively large eyes (nearly isometric relative to SL in Table I material), which might support such a view, and they are also obviously sexually mature at a rather small size. Adult size of *A. paucisquamis* is, however, not exceptionally small for this genus of dwarfs cichlids. We assume here that the head characters are normal for the species.

The wide branchiostegal membrane is not restricted to large specimens, but seems characteristic of the species ; it appears correlated with a short gill cover compared to species with narrow branchiostegal membrane (cf. Fig. 2). In lateral threat display of males, the branchiostegal membrane is expanded (cf. Schmettkamp, 1982, upper photo p. 113) and then contributes considerably to the total lateral surface of the head.

The large mouth may correlate with frontal threat display behaviour of males. Koslowski (1985 and in litt.) recognizes two different frontal threat postures among *Apistogramma* species. *Apistogramma paucisquamis*, *A. agassizii*, *A. bitaeniata*, *A. geophyra* Kullander, *A. cactuoides*, *A. luelingi* Kullander, *A. gibbiceps* and *A. staecki*



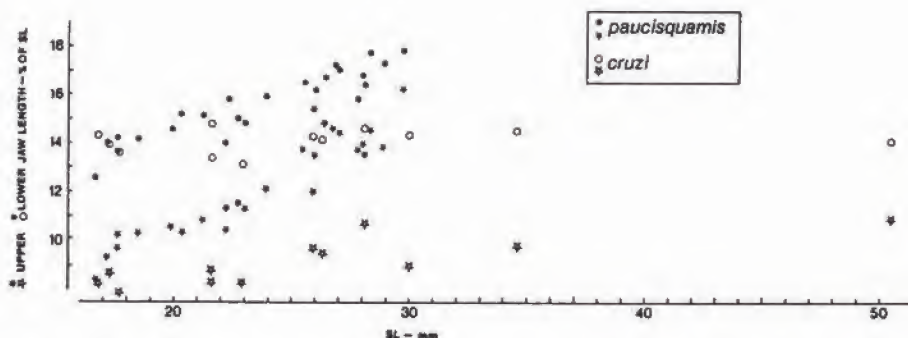


Fig. 8 : Diagram of upper and lower jaw length as per cent of SL plotted against SL (in mm) to show marked positive allometry in *Apistogramma paucisquamis* (n = 25) and near isometry in *A. cruzi* (n = 12, data from Kullander, 1986).

Table II : Linear regression constants and correlation coefficients for upper and lower jaw length as functions of SL in *Apistogramma paucisquamis* and *A. cruzi*.

		a	b	r
<i>A. paucisquamis</i> n = 25, 16.7-29.7 mm SL	upper jaw	- 2.46	- 0.23	0.9790 (P<0.001)
	lower jaw	- 1.59	- 0.22	0.9883 (P<0.001)
<i>A. cruzi</i> n = 12, 16.8-50.5 mm SL	upper jaw	- 0.69	- 0.12	0.9810 (P<0.001)
	lower jaw	- 0.02	- 0.14	0.9822 (P<0.001)

Koslowski, keep their mouths wide open during frontal threats, whereas *A. trifasciata* (Eigenmann & Kennedy), *A. commbrae* (Regan), and species of the *A. regani*, *A. pertensis*, *A. macmasteri* and *A. steindachneri* species groups keep their mouth shut. See Koslowski (1985) for photo documentation. 'Closed mouth' species have small mouths, with isometric jaw growth. Some 'open mouth' species, e.g., *A. agassizii* and *A. gibbiceps*, however, do not have notably large mouths either. A correlation can be only partial, though the possibility of a positive relationship between mouth size and threat behaviour should be recognized.

Referring to the intestinal contents (above), the big mouth, together with the wide branchiostegal membrane, might alternatively be explained as an adaptation to zooplankton feeding. A large orobranchial cavity is more efficient in suction feeding which may be an appropriate mode for collecting very small food items. We note, however, that the oral jaw dentition of large males is specialized, with widely space instead of serrated, strongly recurved canines, suggesting a predator holding or collecting food with the jaws rather than a suction feeder to which jaw teeth are relatively unimportant. Available information is insufficient to explain notable head features of *A. paucisquamis*, but an interesting topic for further studies is suggested.

**Squamation :** Nearly all South American cichlids have 16 or more circumpeduncular scale rows. The only exceptions so far noted are *Taeniacara candidi* Myers and *A. paucisquamis*, which have 12. Among African cichlids species with 12

circumpeduncular scale rows are more common, and both counts may occur within a single genus (e.g., *Steatocranus* Boulenger ; cf. Roberts & Stewart, 1976). Most African cichlids have 16 circumpeduncular scale rows, though higher numbers occur. Thys (1968) discussed the taxonomic value of the character in African cichlids. He considered 16 circumpeduncular scale rows ('caudal scale rows') as the basal number in African cichlids and associated the lower number, 12, with small size and rheophily-associated slender body shape.

In South American cichlid species with 16 circumpeduncular scale rows, these include a median row on each edge, the lateral line row, and bilaterally three rows between the lateral line and the edge epaxially and hypaxially. The lower count is due to loss of one of the scale rows between lateral line and edge, both hypaxially and epaxially and on both sides.

*Apistogramma paucisquamis* does not have exceptional caudal peduncle proportions or particularly large scales. Comparing with other *Apistogramma* species, it appears that the horizontal scale row lost is that next to the median edge row, save that one small scale may be retained posteriorly.

**Fin shape :** The reduced peduncular squamation possibly correlates with caudal fin ray count and shape. There is a high frequency (over 30 %) of specimens with 15 caudal fin rays in the material counted. The caudal fin shape is unusual, being basically lanceolate, though with the middle portion truncate. The longest rays are D3 and V3. In other *Apistogramma* species with caudal fin streamers, the appearance is usually more of a truncate fin with marginal streamers, and the streamers are formed in those species by rays D4-5 and V4-5.

The combination in males of *A. paucisquamis* of a low dorsal fin and a lyreate caudal fin is unusual. With the exception of *A. steindachneri* (Regan), all other *Apistogramma* species so far described that have caudal fin streamers also have produced anterior dorsal fin lappets. In *A. steindachneri* males the dorsal fin as a whole is relatively higher than in *A. paucisquamis*.

**Life colour variation :** With reference to life colour variation among males in the then limited aquarium stock, Schmettkamp (1981) distinguished two forms (see also Koslowski, 1985) : The 'white' form has yellowish chest, white pelvic fin filament and white to bluish white caudal fin spots. The 'orange' form has whitish chest, orange pelvic fin filament and more or less orange to reddish caudal and anal fin. These forms correspond to the extremes in variation among wild material referred to as 1 and 3 above, which because of intermediates and syntopic occurrence apparently represent only extremes in individual expression of red pigment. Extremes include also males characterized by orange or reddish dorsal fin.

**Relationships :** Considering derived character states of *A. paucisquamis*, there are several possible relationship hypotheses. Although 'overall similarity' seems to be strongest with species of the *A. agassizii* group, this assemblage does not present a strong case for monophyly, especially not if *A. paucisquamis* is included.

Koslowski (1985) grouped *A. paucisquamis* with *A. agassizii*, *A. bitaeniata*, *A. geophyra*, *A. elizabethae* Kullander, and *A. pulchra* Kullander, together forming the *agassizii* species group, distinguished by reduced cephalic lateralis system (four instead of five dentary foramina ; two instead of three foramina on second infraorbital), elongate body, wide lateral band, distinct lateral spot, and absence of vertical bars in adults. None of these character states is unique for the group of species. Adding open mouth threat display, a relatively rare trait, the combination of unusual, derived character states indicates a potentially monophyletic group, however.



*Apistogramma cacatuoides* group species have five dentary lateralis foramina (ancestral state) and form a monophyletic assemblage diagnosed by unique sexual dichromatism in abdominal stripes (Kullander, 1986). Marked positive mouth size allometry is shared only with *A. paucisquamis*.

*Taeniacara* Myers is a monotypic genus distinguished from *Apistogramma* by a reduced cephalic lateralis system (cf. Kullander, 1987) which is more similar to that of *A. agassizii* group species than that of most other *Apistogramma*, though featuring further losses. The extremely terete shape characterizing *Taeniacara candidi* may account for the reduced circumpeduncular scale count, shared only with *A. paucisquamis*.

*Apistogramma paucisquamis* resembles species of the *A. pertensis* group (Kullander, 1980a ; Koslowski, 1985) in naked throat and biserial jaw dentition, both of which are derived character states (Kullander, 1980a). The *pertensis* group is, however, not satisfactorily diagnosed.

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